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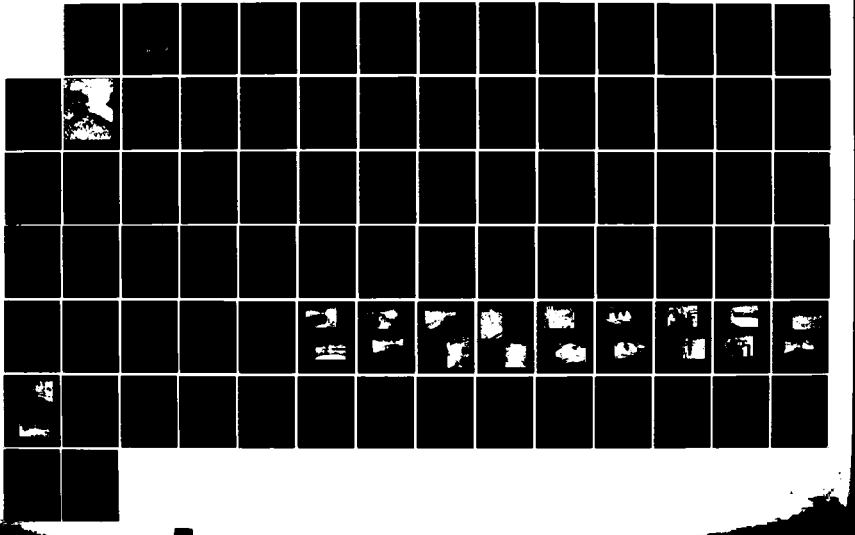
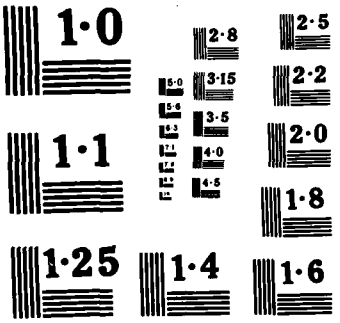




SACO RIVER BASIN

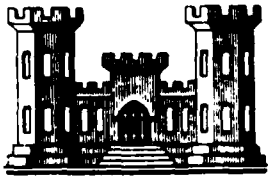
CONWAY, NEW HAMPSHIRE

CONWAY LAKE DAM

NH 00318

NHWRB NO. 52.01

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

NOVEMBER 1978

UNCLASSIFIED

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Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

DAMS, INSPECTION, DAM SAFETY,

Saco River Basin
Conway New Hampshire
Conway Lake Brook

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

THe dam is a 200 ft. long, 17 ft. high earth embankment dam. THe visual inspection of the dam revealed no immediate safety problems. The general condition of the dam is fair. The spillway will not pass the required test flodd. THere are various remedial measures which must be implemented by the owner.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:

NEDED

JAN 1 [illegible] 1979

Honorable Hugh J. Gallen
Governor of the State of New Hampshire
State House
Concord, New Hampshire 03301

Dear Governor Gallen:

I am forwarding to you a copy of the Conway Lake Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Water Resources Board, the cooperating agency for the State of New Hampshire. In addition, a copy of the report has also been furnished the owner, the Town of Conway, Town Office, Conway, New Hampshire, ATTN: Mr. Arthur Seavey, Town Manager.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Water Resources Board for your cooperation in carrying out this program.

Sincerely yours,

[illegible]
[illegible]
Colonel, Corps of Engineers
Division Engineer

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CONWAY LAKE DAM

NH 00318

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SACO RIVER BASIN
CONWAY, NEW HAMPSHIRE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

LETTER OF TRANSMITTAL

FROM THE CORPS OF ENGINEERS TO THE STATE

TO BE SUPPLIED BY THE CORPS OF ENGINEERS

NATIONAL DAM INSPECTION PROGRAM
PHASE I - INSPECTION REPORT
BRIEF ASSESSMENT

Identification No.: 00318

Name of Dam: Conway Lake Dam

Town: Conway

County and State: Carroll, New Hampshire

Stream: Conway Lake Brook

Date of Inspection: September 14, 1978

Conway Lake Dam is a 200 foot long, 17 foot high earth embankment dam. Engineering data available consisted of a set of plans dated 1958 showing plan, elevation and details of additions and improvements to the outlet works structure. No construction specifications or design calculations were available.

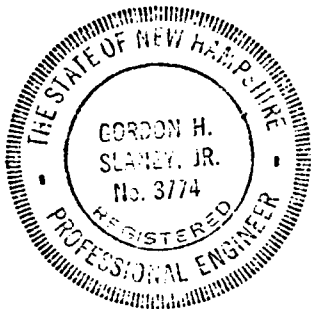
The visual inspection of Conway Lake Dam revealed no immediate safety problems. The general condition of the dam is fair. The inspection revealed a downstream slope covered with brush and tree growth, sloughing of the steep downstream slope, a secondary downstream channel flowing along the toe of the dam and a small debris dam in the secondary channel. Also, the inspection revealed possible seepage through the earth embankment, surface erosion of the right abutment slope, a cracked right training wall of the approach channel, a bent stem on the left control gate and a flow obstructing beam in the approach channel.

Conway Lake Dam's spillway will not pass the required test flood. The dam's spillway capacity is only approximately two percent of the test flood and consequently, the dam would be overtopped by approximately 5.0 feet under test flood conditions. Should the regulating outlets be used during storm conditions, the dam's total outlet capacity would increase to 16.0 percent of the test flood. Overtopping, however, would still occur (4.5 feet) under test flood conditions.

It is recommended that the owner engage a qualified engineer to analyze the stability of the downstream embankment slope and provide recommendations for insuring "long-term" stability of the slope and to further evaluate the potential for overtopping and the inadequacy of the spillway. Provisions should be made by the owner to remove all debris on the downstream slope, remove the small debris dam in the secondary channel, block the upstream end of the secondary channel to prevent water from entering it and eroding the downstream toe of the embankment

and to clear all brush and trees on the upstream slope of the dam. Also, the owner should make provisions to plant appropriate cover on the right abutment slope to prevent erosion, repair the cracked training wall of the approach channel, repair the bent stem of the outlet works gate and remove the abandoned bar screen support from the approach channel.

The recommendations and remedial measures are described in Section 7 and should be addressed within one year after receipt of this Phase I - Inspection Report by the owner.



Gordon H. Slaney, Jr.

Gordon H. Slaney, Jr.
Project Engineer

Howard, Needles, Tammen & Bergendoff
Boston, Massachusetts

This Phase I Inspection Report on Conway Lake Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Richard F. Doherty

RICHARD F. DOHERTY, MEMBER
Water Control Branch
Engineering Division

Joseph A. Mc Elroy

JOSEPH A. MCELROY, MEMBER
Foundation & Materials Branch
Engineering Division

Carney M. Terzian

CARNEY M. TERZIAN, CHAIRMAN
Chief, Structural Section
Design Branch
Engineering Division

APPROVAL RECOMMENDED:

[illegible] B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there by any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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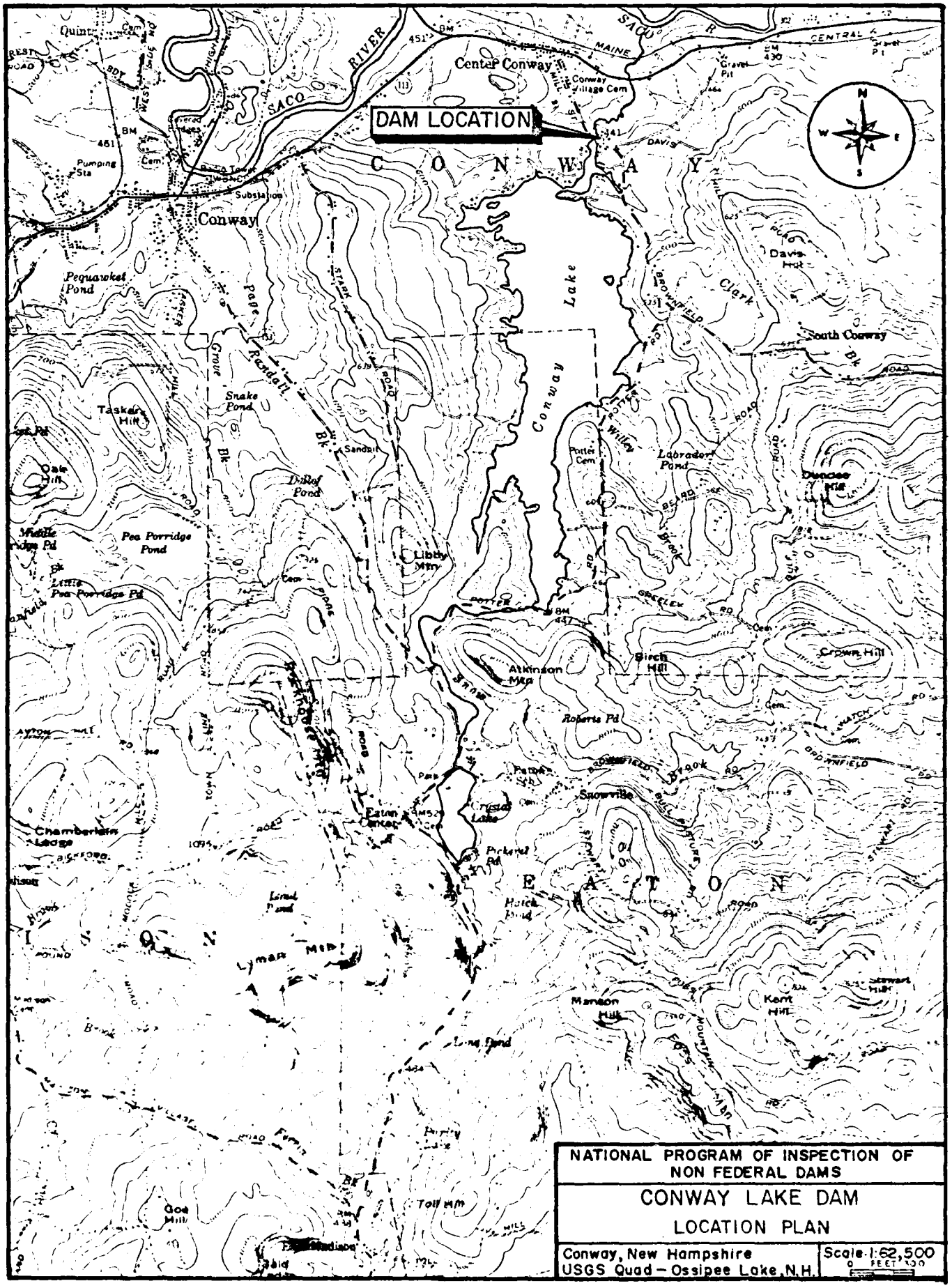
APPENDIXES

CONWAY DAM - Overview looking upstream



NATIONAL PROGRAM OF INSPECTION OF NON FEDERAL DAMS

CONWAY LAKE DAM

LOCATION PLAN

Conway, New Hampshire
USGS Quad – Ossipee Lake, N.H.

Scale 1:62,500
0 FEET 100

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
CONWAY LAKE DAM

SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Howard, Needles, Tammen & Bergendoff has been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed were issued to Howard, Needles, Tammen & Bergendoff under a letter of July 12, 1978 from John P. Chandler, Colonel, Corps of Engineers. Contract No. DACW33-78-C-0356 has been assigned by the Corps of Engineers for this work.

b. Purpose

(1) To perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) To encourage and prepare the states to initiate quickly effective dam safety programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. Conway Lake Dam is located in the Town of Conway, New Hampshire. The brook discharging from Conway Lake flows in a generally northerly direction for a distance of approximately one (1) mile to its confluence with the Saco River. The dam is shown on U.S.G.S. Quadrangle, Ossipee Lake, New Hampshire, with coordinates approximately N 43°59'10", W 71°03'10", Carroll County, New Hampshire. Conway Lake Dam's location is shown on the Location Map immediately preceding this page.

b. Description of Dam and Appurtenances. Conway Lake Dam is an earthfill structure. The dam structure is approximately 200 feet in length. The maximum structural height of the dam, according to existing plans, is about 17 feet. The upstream face has a slope of approximately 2 feet horizontal to 1 foot vertical (2:1) with no riprap visible above or below water level. The downstream face of the dam has a variable slope. Visual inspection of the dam indicated that the stone wall once forming a portion of the downstream face is no longer in existence. The material used for constructing the dam is not known.

The appurtenant works consist of an uncontrolled flat slab stone masonry spillway and a two sectioned mechanically controlled outlet works structure. These structures are located just downstream from and incorporated with the highway bridge on the road passing the north end of the dam.

Figure 1, located in Appendix B, shows the plan of the dam and its appurtenant structures. Photographs of each structure are shown in Appendix C.

c. Size Classification. Intermediate (hydraulic height - 17 feet high, storage - 13,000 acre-feet) based on storage ($\geq$1,000 to 50,000 acre-feet) as given in Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification. The dam's potential for damage rates if as a significant hazard classification. A major breach could result in damage to one or possibly two houses downstream and result in the loss of a few lives. Some damage to the State Highway and Railroad located downstream would also be likely.

e. Ownership. This dam is owned by the Town of Conway, New Hampshire.

f. Operator. This dam is maintained and operated by the Town of Conway, New Hampshire. The Town Manager, located at the Town Office Building, is Mr. Arthur Seavey. Telephone No. (603)447-2767.

g. Purpose of Dam. The purpose of this dam is primarily to create an impoundment of water for recreational use.

h. Design and Construction History. Little information is available regarding the original design and construction of Conway Lake Dam. A set of drawings (3 sheets) was prepared by the Public Service Company of New Hampshire in 1958 for the construction of the present outlet works structure.

The drawings for this dam are available at the New Hampshire Water Resources Board. No in-depth design or construction data were disclosed for this dam.

i. Normal Operational Procedure. Conway Lake Dam is used to create an impoundment of water for recreational purposes. Discussions with the owner revealed that the gates at the dam are opened only during extreme storm flow conditions and that normal operation has the gates closed with the spillway controlling the lake's water level on a year-round basis.

1.3 Pertinent Data

a. Drainage Area. The drainage area above the Conway Lake Dam consists of approximately 23 square miles of rolling, heavily wooded hills. The periphery of Conway Lake is comprised of wooded area with some residences located near the reservoir.

The reservoir area itself contains some islands but is devoid of dead trees protruding through the surface or other visible impediments to navigation. There were some private docks or piers noted along the area inspected.

The watershed supporting Conway Lake is forested rolling terrain with very few flat areas. All areas in the basin are well vegetated with manmade imperviousness being limited to a few paved roads and housing. Topographic elevation in the watershed ranges from about 1,630 to 430 feet MSL.

There are few relatively small tributaries which drain into the lake. The longest of these tributaries is approximately 5.0 miles long with a vertical drop over its length of about 1,000 feet.

b. Discharge at Dam Site

(1) The outlet works for Conway Lake Dam consist of two 5'x5'-6" mechanically operated gates. The lake behind the dam can be lowered about 13 feet below the dam crest elevation of 441.3 by opening either of the sluiceway gates. This drawdown would lower the reservoir area to within 3 or 4 feet of the original river bed elevation of approximately 428.

(2) The maximum discharge at this dam site is unknown.

(3) The spillway capacity with a water surface at the top of the dam (elevation 441.3) is approximately 160 cfs.

(4) The total outlet capacity with both outlet gates open and a water surface at the top of the dam (elevation 441.3) is approximately 940 cfs.

(5) The total project discharge at the test flood elevation of 446.35 is estimated to be 7,020.

c. Elevation (feet above MSL) based on elevation of 437 shown on U.S.G.S. quad sheet assumed to be pool elevation at the spillway crest.

(1) Streambed at centerline of dam - 427.5+.

(2) Maximum tailwater - unknown.

(3) Upstream portal invert diversion tunnel - none.

(4) Recreation pool - 437.

(5) Full flood control pool - N/A.

(6) Spillway crest - 437.

(7) Design surcharge - unknown.

(8) Top dam - 446.35.

(9) Test flood surcharge - 446.35.

d. Reservoir (miles)

(1) Length of maximum pool - 3.6±.

(2) Length of recreational pool - 3.6±.

(3) Length of flood control pool - N/A.

e. Storage (acre-feet)

(1) Recreation pool - 7,300.

(2) Flood control pool - N/A.

(3) Spillway crest pool - 7,300.

(4) Top of dam - 12,885.

(5) Test flood pool - 13,860.

f. Reservoir Surface (acres)

(1) Recreation pool - 1,299.

(2) Flood control pool - N/A Note: Vertical sides assumed.

(3) Spillway crest - 1,299.

(4) Test flood pool - 1,299.

(5) Top dam - 1,299.

g. Dam

(1) Type - stone, earth, concrete.

(2) Length - 200 feet, overall.

(3) Height - 17 feet (maximum).

(4) Top width - 50± feet, but varies.

(5) Side slopes - US = 2:1, DS = Vertical, but varies.

(6) Zoning - unknown.

(7) Impervious core - unknown.

(8) Cutoff - unknown.

(9) Grout curtain - none.

(10) Other - none.

h. Diversion and Regulating Tunnel

See Section j on following page.

i. Spillway

(1) Type - broad crested.

(2) Length of weir - 19 feet (9'± effective length).

(3) Crest elevation - 437.0.

(4) Gates - none.

(5) Upstream channel - the upstream channel passes through a 15 foot wide highway bridge just above the outlet and spillway structure.

(6) Downstream channel - the downstream channel splits and flows around a natural island immediately downstream of the dam. The channel bottom is rocky. The secondary channel, which flows along the toe of the dam, has quite a large amount of debris, including a log and tree branch dam. The main channel is fairly clean.

j. Regulating Outlets The regulating outlet consist of two mechanically operated gates, each 5 foot wide by 5'-6" high. These outlets will allow dewatering to within 3 or 4 feet of the original river bed elevation of 427.5. As the owner has indicated that these outlets would be opened during high flows, additional outlet capacity (see discharge at dam site) can be obtained from the regulating outlets.

SECTION 2
ENGINEERING DATA

2.1 Design

No original design data were disclosed for Conway Lake. A set of drawings (3 sheets) dated 1958 showing additions and improvements made to the spillway and outlet works and a design sketch, dated 1939, were the only design information found.

2.2 Construction

No construction records were available for use in evaluating the dam.

2.3 Operation

No engineering operational data were disclosed.

2.4 Evaluation

a. Availability. Little engineering data were available for Conway Lake Dam. A search of the files of the New Hampshire Water Resources Board and discussion with the owner revealed only a limited amount of recorded information.

b. Adequacy. Because of the limited amount of detailed data available, the final assessment and recommendations of this investigation are based on visual inspection and hydrologic and hydraulic calculations.

c. Validity. The field investigation indicated that the external features of Conway Lake Dam substantially agree with those shown on the available plans.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. The field inspection of Conway Lake Dam was made on September 14, 1978. The inspection team consisted of personnel from Howard, Needles, Tammen & Bergendoff and Geotechnical Engineers, Inc. A representative of the Town of Conway was interviewed but not present during the inspection. Inspection checklists, completed during the visual inspection are included in Appendix A. At the time of the inspection, the water level was approximately 8 inches below the spillway crest elevation. The upstream face of the dam could only be inspected above this water level.

b. Dam. The dam is an earth embankment with outlet works and spillway section at the right abutment. Visual inspection of the dam embankment showed no signs of immediate distress.

Upstream Slope

The upstream slope above pool elevation contains small trees and brush.

Crest

An asphalt pavement forms the crest of the dam. No indication of misalignment of the dam was observed.

Downstream Slope

A sketch of the dam dated September 28, 1939, indicates that a vertical stone wall once formed the downstream toe of the embankment for a distance of about 100 feet from the spillway section. The sketch also notes "washed under" in the stone wall area near the spillway.

Visual inspection of the dam indicated that the stone wall referred to in the 1939 sketch no longer exists. The downstream slope is very steep (vertical in places) and is strewn with debris consisting mainly of saw cut, decayed logs and cobbles and boulders of various sizes, as shown in Photos 6, 7 and 8. The cobbles and boulders may be remnants of the old stone wall. The downstream slope is covered with brush and trees, and this vegetation can be seen in Photo 9 which is a view of the downstream slope near the left abutment. The steep downstream slope is sloughing in places. A stability

analysis of the downstream slope should be made to determine what corrective measures need be taken to provide for "long-term" stability of the slope.

Water overtopping the spillway or passing through the outlet works can enter one of two downstream channels. The main downstream channel is approximately perpendicular to the crest of the dam. A secondary channel follows the toe of the downstream slope until it reaches the left abutment where it turns away from the dam and eventually joins the main channel. The secondary channel contains a small debris dam about 50 feet downstream of its turn, away from the main dam. Although no measurements were made, it appears as if flow in the secondary channel increases from the spillway to the debris dam which may indicate seepage through the earth embankment.

Water should be prevented from entering the secondary channel because of the potential for the flowing water to undermine the downstream slope of the embankment. Failure of the old stone wall may have been the result of erosion of its supporting soil by water flowing in the secondary downstream channel. The small debris dam should be removed because it raises the water level in the secondary downstream channel causing erosion of the downstream toe to occur at higher elevations.

A small seep was observed in the earth embankment near the left abutment about 5 feet above the secondary downstream channel elevation. The seep occurs through a pile of boulders and decayed logs and has formed a small erosion channel behind the pile of boulders. The boulders and logs could not be moved to inspect the seepage zone in more detail.

Surface erosion was observed on the right abutment slope immediately downstream of the concrete outlet works. This erosion was presumably caused by surface water runoff from the parking lot.

c. Appurtenant Structures. Visual inspection of the concrete spillway structure, outlet works structure and approach channel did not reveal any evidence of stability problems. The concrete surface generally appeared to be in good condition except for one crack in the right training wall of the approach channel structure.

The spillway section consists of a shaped stone gravity wall and a concrete slab which is separated from the dam embankment by the left training wall. Both the left and right walls and the spillway crest are in good condition as is shown in Photos 12 and 13.

The outlet works structure, shown in Photos 11 and 14, is formed by three massive piers and two diaphragm walls. The outlet works contains two mechanically operated wooden gates each with an effective opening of 5.0 feet by 5.5 feet. The outlet works structure is located just above the river bed elevation between the spillway structure and its extension of the right training wall.

The mechanically operated wooden gates and the concrete surface of this structure are in good condition. The stem of the left gate is, however, bent and causes difficulty in operation. Both gates were reported operational by the owner. Some debris appeared to have worked its way between the top of the gate and the outlet works structure allowing water to pass through the gate at this point. The steel walkways and handrails appeared rusty but structurally sound.

The approach channel to the outlet works and spillway structure passes under the upstream roadway and is formed by the bridge abutments, spillway structure and the right training wall of the outlet structure. On the day of the inspection, the water level was about 8 inches below the spillway crest and there were no visible signs of deterioration of either side of the approach channel except for one vertical crack in the concrete of the right training wall (Photo 15). The approach channel generally appeared to be in good condition. Just upstream of the outlet works structure and immediately downstream from the roadway bridge is a steel beam which apparently was used to support a bar screen for penstock waters (penstock long abandoned and removed). This beam is an obstruction to the free flow of water though the spillway and outlet works structures and could cause debris to build up such that the approach channel could become blocked. During the inspection a large tree stump was observed behind this beam, under the roadway bridge section.

d. Reservoir Area. The reservoir slopes are generally covered with trees and brush. A more detailed description of the drainage area is included in Section 1.3 of this report. Cottages are scattered along the shoreline. The amount of siltation within the reservoir is unknown.

e. Downstream Channel. The channel immediately downstream of the dam splits and flows around a natural island and then joins to form one channel. The main channel flows approximately perpendicular to the dam, the secondary channel flows parallel to the toe of the dam. The secondary downstream channel may cause serious undercutting of the downstream embankment slope if it is allowed to carry water adjacent to the toe. The situation is aggravated by the small debris dam

because this small dam raises the water level in the secondary downstream channel causing erosion of the downstream toe to occur at higher elevations. The debris dam should be removed and provisions made for blocking flow into the secondary downstream channel altogether.

Trees overhang the main discharge channel but pose no immediate hazard to the dam. Photo 19 is a view of the main discharge channel from the top of the spillway. The right bank of the main channel contains concrete craddle supports for a penstock (no longer existing) which fed a powerhouse about 350 feet downstream. This powerhouse has been long abandoned, with only the foundation remaining on the right bank of the channel. At the old powerhouse site there is another secondary channel (powerhouse discharge channel) paralleling the main channel for a distance of about 100 feet.

3.2 Evaluation

Visual examination reveals no immediate safety problems. The condition of the dam is fair. The inspection revealed the following:

(a) A downstream slope covered with brush and tree growth.

(b) Sloughing of the steep downstream slope.

(c) A secondary downstream channel flowing along the toe of the dam.

(d) A small debris dam in the secondary channel.

(e) Possible seepage through the earth embankment.

(f) Slight seepage at the left abutment.

(g) Surface erosion of the right abutment slope.

(h) Cracked right training wall of the approach channel.

(i) Bent stem on the left control gate.

(j) Flow obstructing beam in the approach channel.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedure

The Conway Lake Dam is used primarily for the retention of Conway Lake which is used for recreational purposes. Discussions with the owner revealed that the gates are opened only during extreme storm flow conditions and that normal operation has the gates closed with the spillway controlling the lake's water level on a year-round basis.

4.2 Maintenance of Dam

Grounds work, painting and debris removal work are all performed on an as needed basis.

During 1958, repairs were made to the dam which included the reconstruction of the outlet works structure.

4.3 Maintenance of Operating Facilities

Maintenance on the outlet works facilities is done on an as needed basis.

4.4 Description of Warning Systems

There are no warning systems in effect at this facility.

4.5 Evaluation

The current operation and maintenance procedures for Conway Lake Dam are inadequate to insure that all problems encountered can be remedied within a reasonable period of time. The owner should establish a written operation and maintenance procedure as well as establishing a warning system to follow in event of flood flow conditions or imminent dam failure.

SECTION 5
HYDROLOGY AND HYDRAULIC ANALYSIS

5.1 Evaluation of Features

a. General. Conway Lake Dam is an earthfill structure with a total length of approximately 200 feet and a maximum structural height of 17 feet. The appurtanent works consist of a 19 foot spillway and an outlet works structure. The outlet works structure consists of two wooden control gates, each having an opening 5.0 feet wide by 5.6 feet in height.

The dam creates an impoundment of water primarily used for recreational purposes. Conway Lake Dam is classified as being intermediate in size having a maximum storage of 13,000 acre-feet.

b. Design Data. No hydrologic or hydraulic design data were disclosed for Conway Lake.

c. Experience Data. The maximum discharge at this dam site is unknown.

d. Visual Observations. No evidence of damage to any portion of the project from overtopping was visible at the time of the inspection.

e. Overtopping Potential. As no detailed design and operational information are available, hydrologic evaluation was performed using dam information gathered by field inspection, watershed size and an estimated test flood equal to one-half the Probable Maximum Flood (PMF) as determined by guide curves issued by the Corps of Engineers. Based on a drainage area of 23 square miles, it was estimated that the test flood inflow at Conway Lake Dam would be 16,100 cfs. Following the guidance for Estimating Effect of Surcharge Storage on Maximum Probable Discharge results in a test flood discharge of 7,020 cfs. As the maximum spillway capacity of the top of the dam is 160 cfs (approximately two percent of the test flood discharge flow), the test flood will cause the dam to be overtopped by approximately 5.0 feet. As the owner has indicated that the outlets would be opened in the event of high flows, an additional outlet capacity of 940 cfs could be assumed. This would increase the dam's outlet capacity to 16.0 percent of the test flood. Overtopping (approximately 4.5 feet) would however still occur under test flood conditions.

f. Dam Failure Analysis. The impact of failure of the dam at maximum pool was assessed using the "Rule of Thumb"

Guidance for Estimating Downstream Dam Failure Hydrographs issued by the Corps of Engineers. The analysis covered the reach extending from the dam to the Saco River. Failure of Conway Lake Dam at maximum pool would probably result in an increase in the downstream depth of about 5 feet. An increase in water depth of this magnitude might damage one or possibly two houses downstream and may result in the loss of a few lives. Some damage to the State highway and the downstream railroad would also be likely.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. An old stone wall shown on a sketch, dated 1939, no longer exists. The downstream slope of the embankment is very steep and sloughing has occurred in places. The stability of the downstream slope should be analyzed further.

b. Design and Construction Data. A design sketch dated 1939 was available and showed the old outlet structure, spillway and stone wall to the left of the spillway. Design drawings of the 1958 outlet structure reconstruction were also available. Design data on the earth embankment were not made available and the Phase I safety analysis of the earth embankment must be made mainly from visual examination.

c. Operating Records. No operating records were made available.

d. Post-Construction Changes. Since the original construction, a new outlet structure has been constructed at the right abutment of this dam. This outlet structure provides a maximum waterway opening of 10 feet wide by 5.5 feet high. This new structure was constructed in 1958.

e. Seismic Stability. The dam is located in Seismic Zone 2, and in accordance with recommended Phase I guidelines does not warrant seismic analysis.

SECTION 7
ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. The visual inspection of Conway Lake Dam did not disclose any findings that indicate an immediate unsafe condition. The observed condition of the dam was fair. The inspection revealed the following:

(1) A downstream slope covered with brush and tree growth.

(2) Sloughing of the steep downstream slope.

(3) A secondary downstream channel flowing along the toe of the dam.

(4) A small debris dam in the secondary channel.

(5) Possible seepage through the earth embankment.

(6) Slight seepage at the left abutment.

(7) Surface erosion of the right abutment slope.

(8) Cracked right training wall of the approach channel.

(9) Bent stem on the left control gate.

(10) Flow obstructing beam in the approach channel.

The hydraulic analysis reveals that the dam cannot pass the required test flood without overtopping the dam.

b. Adequacy of Information. Existing drawings, when combined with the visual inspection, permit an adequate Phase I evaluation of the dam safety to be made.

c. Urgency. This dam is in generally fair condition. The recommendations and remedial measures described in Sections 7.2 and 7.3 should be accomplished within one year after receipt of this Phase I Inspection Report by the owner.

d. Necessity of Additional Investigation. The findings of the visual investigation indicate that the owner should engage a qualified engineer to analyze the stability of the downstream embankment slope and provide recommendations for insuring "long-term" stability of the slope.

7.2 Recommendations

It is recommended that the owner engage a qualified engineer to analyze the stability of the downstream embankment slope and provide recommendations for insuring "long-term" stability of the slope and to further evaluate the potential for overtopping and the inadequacy of the spillway.

7.3 Remedial Measures

a. Debris on the downstream slope should be removed.

b. The small debris dam on the secondary discharge channel should be removed as soon as possible to minimize erosion of the downstream toe of the embankment.

c. The secondary discharge channel should be blocked at its upstream end to prevent water from entering it and eroding the downstream toe of the embankment.

d. The upstream slope should be cleared of brush and trees; appropriate cover should be planted on the slope to prevent erosion.

e. The right abutment slope should be planted with appropriate cover to prevent erosion of the abutment due to surface water runoff from the parking lot.

f. The cracked right training wall of the approach channel should be repaired.

g. The bent stem on the left gate of the outlet works structure should be replaced.

h. The abandoned bar screen beam in the approach channel should be removed.

i. A written operational procedure to follow in the event of flood flow conditions or imminent dam failure should be developed.

j. The technical inspection program should be continued on a bi-annual basis.

7.4 Alternatives

There are no practical alternatives to the recommendations of Section 7.2 and 7.3 except that on an interim basis the owner may consider operating the reservoir at a lower level throughout the year so as to provide more storage for extreme flood events.

APPENDIX A

VISUAL CHECKLIST WITH COMMENTS

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Conway Lake

DATE September 14, 1978

TIME 9 a.m.

WEATHER 70°F - Sunny

W.S. ELEV. 436.3 U.S. 428.0 DN.S

PARTY:

1. Gordon Slaney - HNTB
2. Stan Mazur - HNTB
3. Dan LaGatta - GEI
4. Tom Keller - GEI
5.
6.
7.
8.
9.
10.

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	Dam	Dan LaGatta, Tom Keller	
2.	Spillway, Outlet and	Stan Mazur, Gordon Slaney	
3.	Downstream Channel		
4.			
5.			
6.			
7.			
8.			
9.			
10.			

PERIODIC INSPECTION CHECK LIST

PROJECT Conway Lake — DATE September 14, 1978

PROJECT FEATURE Dam — NAME D.P. LaGatta

DISCIPLINE Geotechnical Engineer — NAME T.O. Keller

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	
Current Pool Elevation	3'8½" from water surface to bottom of bridge beam on upstream (south) side.
Maximum Impoundment to Date	
Surface Cracks	Asphalt pavement contains surficial cracks typical of asphalt pavements; these cracks cannot be traced to misalignment of dam.
Pavement Condition	Good.
Movement or Settlement of Crest	None observed.
Lateral Movement	None observed.
Vertical Alignment	No misalignment observed.
Horizontal Alignment	No misalignment observed.
Condition at Abutment and at Concrete Structures	See text for condition of dam at left and right abutments.
Indications of Movement of Structural Items on Slopes	Stone wall built to retain downstream slope left of spillway had toppled. See text for details.
Trespassing on Slopes	Numerous paths in upstream slope from road to pond. Some paths provide access to boats moored to upstream slope. Downstream slope strewn with decayed cut logs.
Sloughing or Erosion of Slopes or Abutments	Considerable sloughing of downstream slope left of spillway. See text.
Rock Slope Protection - Riprap Failures	No riprap.
Unusual Movement or Cracking at or near Toes	Downstream toe undercut by channel flowing parallel to toe.
Unusual Embankment or Downstream Seepage	Seepage observed from downstream slope near left abutment 5' above water in channel.
Piping or Boils	None observed.
Foundation Drainage Features	None observed.
Toe Drains	None observed.
Instrumentation System	None.
Vegetation	Extensive trees and brush.

PERIODIC INSPECTION CHECK LIST

PROJECT Conway Lake DATE September 14, 1978

PROJECT FEATURE Intake Channel/Structure NAME D.P. LaGatta, S. Mazur

DISCIPLINE Structural, Hydraulic/Geotechnical Engineers NAME T.O. Keller, G. Slaney

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	Approach channel for outlet works and spillway is one in the same. The channel passes under roadway.
Slope Conditions	
Bottom Conditions	Beneath water.
Rock Slides or Falls	None.
Log Boom	None.
Debris	Tree stump under roadway bridge.
Condition of Concrete Lining	Crack in right wall. Otherwise good.
Drains or Weep Holes	None visible.
b. Intake Structure	
Condition of Concrete	Good.
Stop Logs and Slots	None.

PERIODIC INSPECTION CHECK LIST

PROJECT Conway Lake DATE September 14, 1978

PROJECT FEATURE Control Tower NAME S. Mazur

DISCIPLINE Structural, Hydraulic/Engineers NAME G. Slaney

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	Control Tower and outlet structure are one and the same. Outlet structure consists of two 5 foot by 5.5 foot mechanically operated gates.
a. Concrete and Structural	
General Condition	Good.
Condition of Joints	Good.
Spalling	None observed.
Visible Reinforcing	None observed.
Rusting or Staining of Concrete	None observed.
Any Seepage or Efflorescence	None observed.
Joint Alignment	Good.
Unusual Seepage or Leaks in Gate Chamber	Leakage at top of gate due to debris forcing opening at juncture with gate and outlet structure.
Cracks	
Rusting or Corrosion of Steel	Walkway and rail rusty.
b. Mechanical and Electrical	Gates are mechanically operated. Stem of left gate is bent. Otherwise gates in good condition.
Air Vents	
Float Wells	
Crane Hoist	
Elevator	
Hydraulic System	
Service Gates	
Emergency Gates	
Lightning Protection System	
Emergency Power System	
Wiring and Lighting System	

PERIODIC INSPECTION CHECK LIST

PROJECT Conway Lake DATE September 14, 1978

PROJECT FEATURE NAME

DISCIPLINE NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	
General Condition of Concrete	None.
Rust or Staining on Concrete	
Spalling	
Erosion or Cavitation	
Cracking	
Alignment of Monoliths	
Alignment of Joints	
Numbering of Monoliths	

PERIODIC INSPECTION CHECK LIST

PROJECT Conway Lake DATE September 14, 1978

PROJECT FEATURE Outlet Structure/Channel NAME D.P. LaGatta, S. Mazur

DISCIPLINE Structural, Hydraulic/Geotechnical Engineers NAME T.O. Keller, G. Slaney

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	See also Control Tower
General Condition of Concrete	Good.
Rust or Staining	Walkway and rail rusty.
Spalling	None observed.
Erosion or Cavitation	None observed.
Visible Reinforcing	None observed.
Any Seepage or Efflorescence	None observed.
Condition at Joints	Good.
Drain Holes	None observed.
Channel	Good condition - outlet channel is the same as discharge channel for spillway weir.
Loose Rock or Trees Overhanging Channel	None of significance.
Condition of Discharge Channel	Good.

PERIODIC INSPECTION CHECK LIST

PROJECT Conway Lake — DATE September 14, 1978

PROJECT FEATURE Spillway and Channels — NAME D.P. LaGatta, S. Mazur

DISCIPLINE Structural, Hydraulic/Geotechnical Engineers — NAME T.O. Keller, G. Slaney

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	Approach channel for spillway weir is the same as intake channel for outlet works.
General Condition	
Loose Rock Overhanding Channel	
Trees Overhanging Channel	
Floor of Approach Channel	
b. Weir and Training Walls	
General Condition of Concrete	Good.
Rust or Staining	None observed
Spalling	None observed.
Any Visible Reinforcing	None observed.
Any Seepage or Efflorescence	None observed.
Drain Holes	
c. Discharge Channel	
General Condition	Good.
Loose Rock Overhanging Channel	Insignificant regarding present safety.
Trees Overhanging Channel	Insignificant regarding present safety.
Floor of Channel	Good.
Other Obstructions	Debris dam on natural secondary downstream channel, approximately 250' from spillway structure (see text).

PERIODIC INSPECTION CHECK LIST

PROJECT Conway Lake DATE September 14, 1978

PROJECT FEATURE Service Bridge NAME

DISCIPLINE Structural Engineer NAME S. Mazur

AREA EVALUATED	CONDITION
OUTLET WORKS - SERVICE BRIDGE	This facility has no Service Bridge.
a. Super Structure	
Bearings	
Anchor Bolts	
Bridge Seat	
Longitudinal Members	
Under Side of Deck	
Secondary Bracing	
Deck	
Drainage System	
Railings	
Expansion Joints	
Paint	
b. Abutment & Piers	
General Condition of Concrete	
Alignment of Abutment	
Approach to Bridge	
Condition of Seat & Backwall	

APPENDIX B

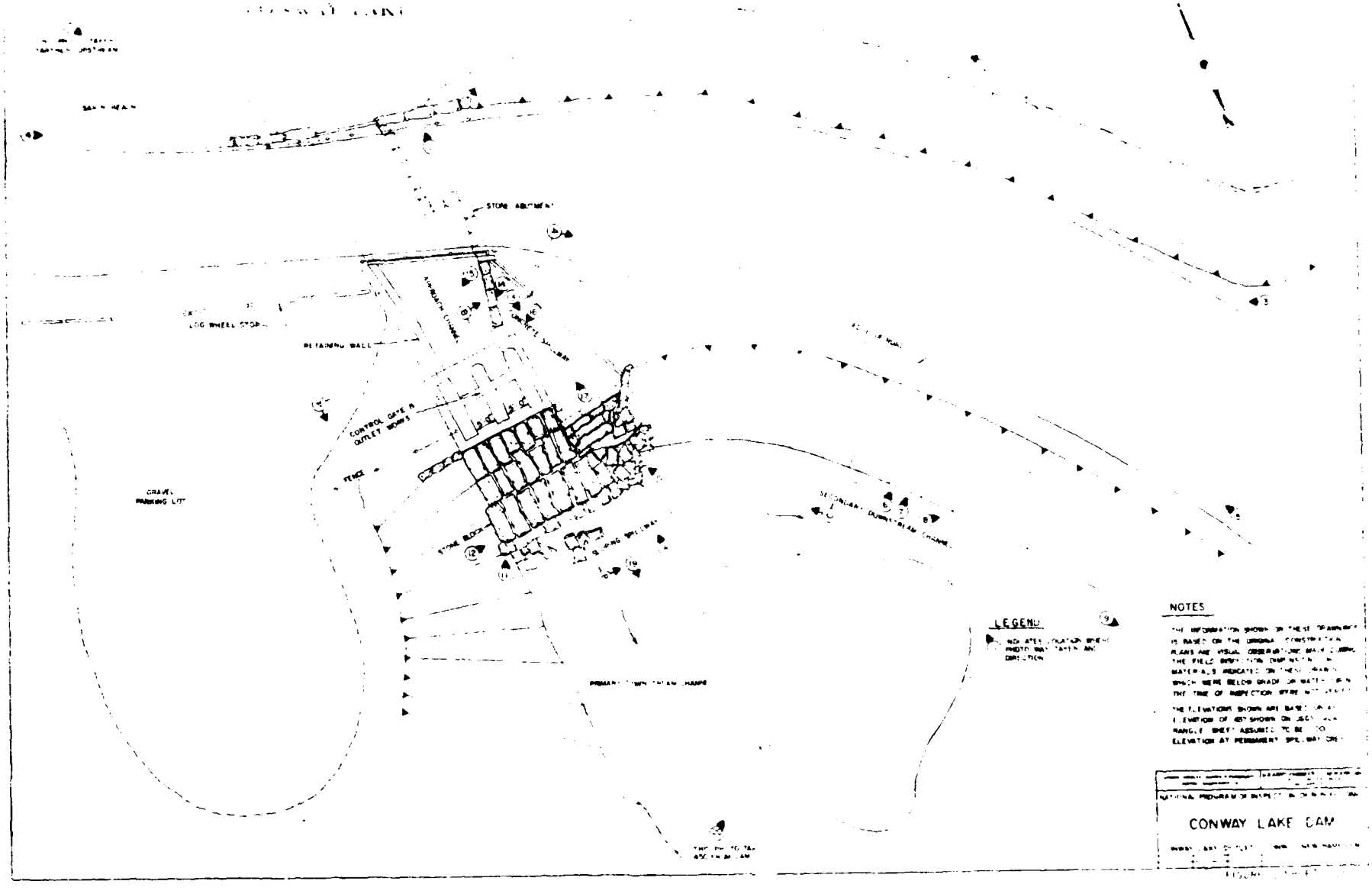
1. LIST OF DESIGN, CONSTRUCTION AND MAINTENANCE RECORDS

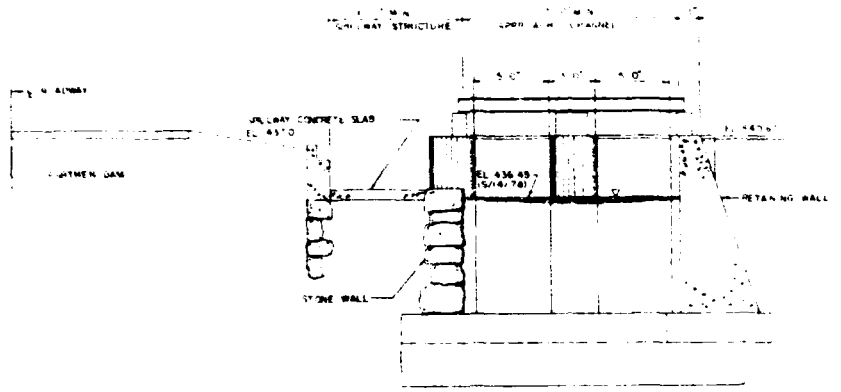
2. PAST INSPECTION REPORTS

3. PLAN AND DETAILS

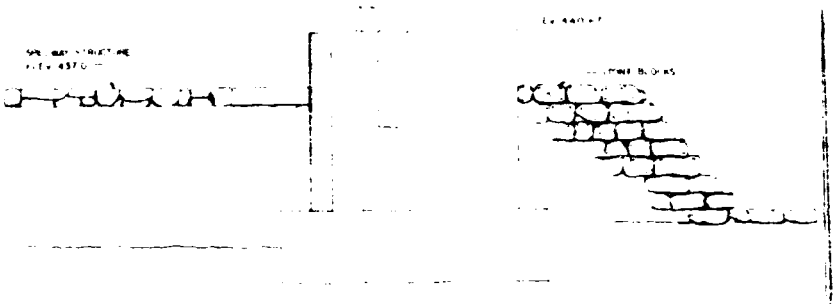
AVAILABLE ENGINEERING DATA

A set of drawings (3 sheets), dated 1958, showing additions and improvements made to the existing dam is available at the State of New Hampshire Water Resources Board, 37 Pleasant Street, Concord, New Hampshire 03301.

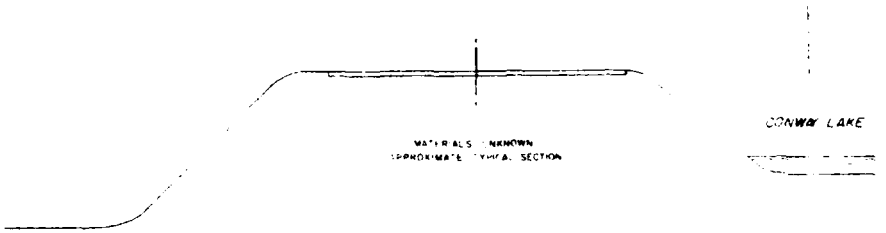

STONE ABUTMENT
LOG WHEEL STOP
RETAINING WALL
CONTROL GATE & OUTLET WORKS
FENCE
GRAVEL PARKING LOT
STONE BLOCK
LEGEND
NOTES
CONWAY LAKE DAM



SECTION A-A



SECTION B-B



SECTION C-C

CONWAY LAKE DAM

FIGURE

PAST INSPECTION REPORTS

N. H. WATER RESOURCES BOARD
Concord, N. H. 03301

DAM SAFETY INSPECTION REPORT FORM

Town: Conway Dam Number: 52.01

Inspected by: SCB Date: 1 Jul 1974

Local name of dam or water body: _____

Owner: Town of Conway Address: _____

Owner was/was not interviewed during inspection.

Drainage Area: _____ sq. mi. Stream: _____

Pond Area: _____ Acre, Storage _____ Ac-Ft. Max. Head _____ Ft.

Foundation: Type _____, Seepage present at toe - Yes/No, _____

Spillway: Type Over Flow, Freeboard over perm. crest: 3,

Width 10', Flashboard height None,

Max. Capacity _____ c.f.s.

Embankment: Type _____, Cover _____ Width _____,

Upstream slope _____ to 1; Downstream slope _____ to 1

Abutments: Type _____, Condition: Good, Fair, Poor

Gates or Pond Drain: Size 2-6'x6' Capacity _____ Type _____

Lifting apparatus Stanbent Operational condition _____

Changes since construction or last inspection: _____

_____

_____

Downstream development: _____

This dam would/~~would not~~ be a menace if it failed.

Suggested reinspection date: _____

Remarks: _____

_____

_____

_____

STATE OF NEW HAMPSHIRE
INTER-DEPARTMENT COMMUNICATION

DATE October 16, 1975

FROM Vernon A. Knowlton AT (OFFICE)
Chief Engineer

SUBJECT Field Inspection - Conway Lake Dam, Conway, New Hampshire

TO File

On October 10, 1975 Mr. J. Willcox Brown, member of the Water Resources Board, and myself inspected the dam at the outlet of Conway Lake. This structure consisted of a concrete overflow section and two gates, one of which had operating problems. It appears the town has opened this gate to lower the pond so that repairs can be made in the near future. Our understanding is a bent stem causes the gate to bind and prevents it from opening.

This dam requires an operator since the spillway is quite limited. A horseshoe type structure would be required to improve conditions.

VAK/pd

State of New Hampshire

WATER RESOURCES BOARD

37 Pleasant St.
CONCORD 03301

December 11, 1975

Town of Conway
Conway
N. H.

Gentlemen:

Under the provisions of RSA-Chapter 482, Sections 8 through 15, the New Hampshire Water Resources Board is authorized to inspect all dams in the state which by reason of their physical condition, height, and location may be a menace to the public safety.

The dam structure (Dam # 52.01) located on your property in Conway was inspected on 7-1-74 and as a result of this inspection no discrepancies were found at the time of the inspection which would require any corrective measures.

This letter is provided for your information only. If you have any questions, please feel free to call or write.

Sincerely,

George M. McGee Sr.

George M. McGee, Sr.
Chairman

GMM/SCB:L

cc:

NEW HAMPSHIRE

WATER CONTROL COMMISSION

REPORT

ON THE

PRELIMINARY INVESTIGATION

OF

WATER LEVEL CONDITIONS ON CONWAY LAKE

CONWAY & EATON, N. H.

CONCORD, N. H.
MARCH, 1941

INDEX

ADDENDA

REPORT

ON THE

PRELIMINARY INVESTIGATION

OF

WATER LEVEL CONDITIONS ON CONWAY LAKE

CONWAY & EATON, N. H.

In accordance with Section 47, Chapter 133, a preliminary investigation has been made of the lake level variations effecting the use and enjoyment by the public of Conway Lake. This study is made in response to a petition of ten owners of property on this Lake submitted January 17, 1941, a copy of which is appended. An inspection trip was made to the site on March 8, 1941.

LOCATION

Conway Lake is located in the Towns of Conway and Eaton. It discharges into a small stream which enters the Saco River about one mile below Conway Lake dam at a point on the Saco River about one mile above the Maine-New Hampshire line.

BASIC DATA

Drainage Area	26 sq.mi.
Water Area	1299 acres
Elevation of Water Surface U.S.G.S. Base	437± feet
Maximum Draw	8.8 feet

DESCRIPTION OF DAM

The dam is a composite structure consisting of a stone masonry spillway, a concrete head works, and earth wing walls. It is located just downstream from and incorporated with the highway bridge on the road passing the north end of the dam.

Data on Dam

Total Length	200 feet
Spillway Length	19 feet
Freeboard	3.2 feet
Maximum Height	14± feet
One Gate	5.8 feet wide x 5.8 feet high

At one time this dam was used to create head for a power development. This development had a capacity of 355 h.p., but has been discarded and the wooden penstock and power house have been removed.

OWNERSHIP

The dam and flowage rights at Conway Lake were originally owned by the Conway Electric Light & Power Company. They are now owned by the Public Service Company of New Hampshire.

PRESENT OPERATION

Water is released from Conway Lake as required in the Swans Falls Power Development of the Public Service Company of New Hampshire, which is located on the Saco River a short distance below the mouth of Conway Lake Brook. The water then

passes down river and is used again in several hydroelectric plants located in Maine owned by the Cumberland County Power & Light Company.

The water in Conway Lake has apparently been kept at an elevation suitable for recreational purposes at all times during recent summer months except during the summer of 1940.

RECREATIONAL DEVELOPMENT

The natural outlet to Conway Lake appears to be about one-half mile south of the dam. The dam forms an artificial bay extending from the dam upstream to the natural outlet of the Lake. When the water level is lowered unduly, there remains only a narrow waterway in this bay with wide flat areas of lake bottom exposed between it and the bank at full lake. The boat piers are left high and dry and use of boats is handicapped.

Most of the camps on this Lake are concentrated around this bay. There are in excess of 25 summer cottages of good quality built on the shores of this bay. The building of camps has been concentrated in this area probably because of its accessibility and the presence of high and dry shore land.

PREVIOUS COMPLAINTS ON RECORD

On January 13, 1936 a complaint was made to the Department of Fisheries and Game. The complaint was that the low water conditions existing in the winter were detrimental to the fishing in Conway Lake. It was claimed that by drawing the water, the ice reduced the depth of water and forced the small fish to leave the coves and go into deeper water where they were eaten by the larger fish. This complaint was referred to the Public Service Commission, who planned a conference between the Fish and Game Commissioner, the Attorney General, and officials of the Public Service Company of New Hampshire. There is no record that such a conference was held or that any agreement was reached.

CONCLUSION

There would be a definite checking of further growth for recreational use of this Lake and a reduction in value of existing property if the practice of lowering the Lake level during the summer months was continued.

The summer of 1940 was an exceptionally dry period and it is quite probable that this may account for the rather unusual excessive drawing of the Lake.

The matter has been brought to the attention of officials of the Public Service Company of New Hampshire who are investigating the matter for future consideration.

Respectfully submitted,

Richard S. Holmgren
Chief Engineer

RSH:GMB
March, 1941

ADDENDA

A Copy of Petition

Form WCC.3
7/30/37

THE STATE OF NEW HAMPSHIRE

County of Carroll, ss. 1/17/41 193.

PETITION FOR LAKE LEVEL INVESTIGATION

AT Conway Lake, Center Conway, N.H.

TO THE WATER CONTROL COMMISSION:

In compliance with the provisions of Laws of 1937, c.133, an act establishing a Water Control Commission,

We, the undersigned hereby request the New Hampshire Water Control Commission to make a preliminary investigation of water level conditions on Conway Lake, located in the towns of Conway and Eaton, whose outlet is discharged into Saco ~~Sroux~~ River. The dam controlling this body of water is located in the town of Conway and is owned by Public Service Co. of N.H. whose mail address is Manchester, N.H.

Our specific complaint is as follows:- Record low water 1940. Pier completely out of water. Inability to use boat with safety because of rocks, stumps, etc.
(Additional information may be given on sheets to be attached hereto)

(A minimum of 10 signatures of property owners on said Lake required)

Signer	Mail Address
1. Edna Chase Rodenbeck	21 Homestead Ave., Scarsdale, N.Y.
2. Edward Rodenbeck	21 Homestead Ave., Scarsdale, N. Y.
3. Leslie C. Hill	Center Conway, N. H.
4. Wilbur F. Meader	Center Conway, N. H.
5. Geo. H. Chapman	152 Prospect St., Portland, Maine
6. Wm. H. Chapman	119 Glenwood Ave., Portland, Maine
7. Albert P. Davidson	Center Conway, N. H.
8. F. H. Robinson	North Conway, N. H.
9. Mrs. N. L. Potter	Center Conway, N. H.
10. Richard D. Batiste	19 Park Pl., Bronxville, N. Y.

APPENDIX C

PHOTOGRAPHS

FOR LOCATION OF PHOTOS, SEE FIGURE 1
LOCATED IN APPENDIX B

PHOTO NO. 1 - General view of reservoir from dam.

PHOTO NO. 2 - View of reservoir and dam from right reservoir side.

PHOTO NO. 3 - General view of dam from left abutment (Upstream Side).

PHOTO NO. 4 - View of dam and roadway bridge from right abutment (Upstream Slope).

PHOTO NO. 5 - View of dam from left abutment (Downstream Slope).

PHOTO NO. 6 - View of dam embankment from downstream side.

PHOTO NO. 7 - Close-up view of decayed logs and boulders on downstream slope of embankment.

PHOTO NO. 8 - Close-up view of decayed logs on downstream slope of embankment.

PHOTO NO. 9 - Downstream slope of embankment near left abutment showing trees and brush. Secondary downstream channel can be seen at toe of slope.

PHOTO NO. 10 - View of spillway and outlet works from downstream channel.

PHOTO NO. 11 - View of outlet works structure, downstream side.

PHOTO NO. 12 - View of spillway structure.

PHOTO NO. 13 - View of spillway slab looking downstream.

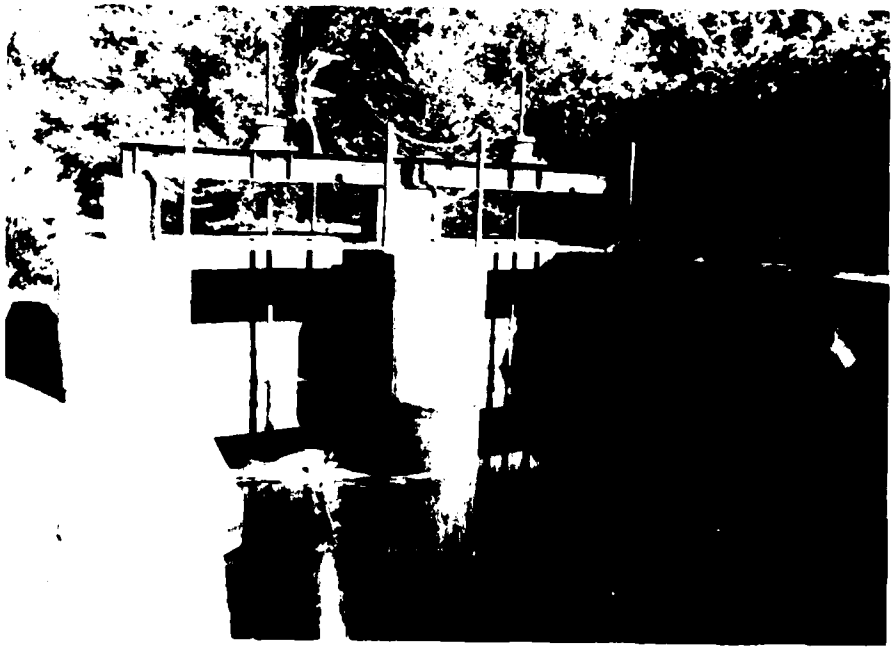


PHOTO NO. 14 - Outlet works structure, view from dam.

PHOTO NO. 15 - View of right training wall, approach to outlet works structure.

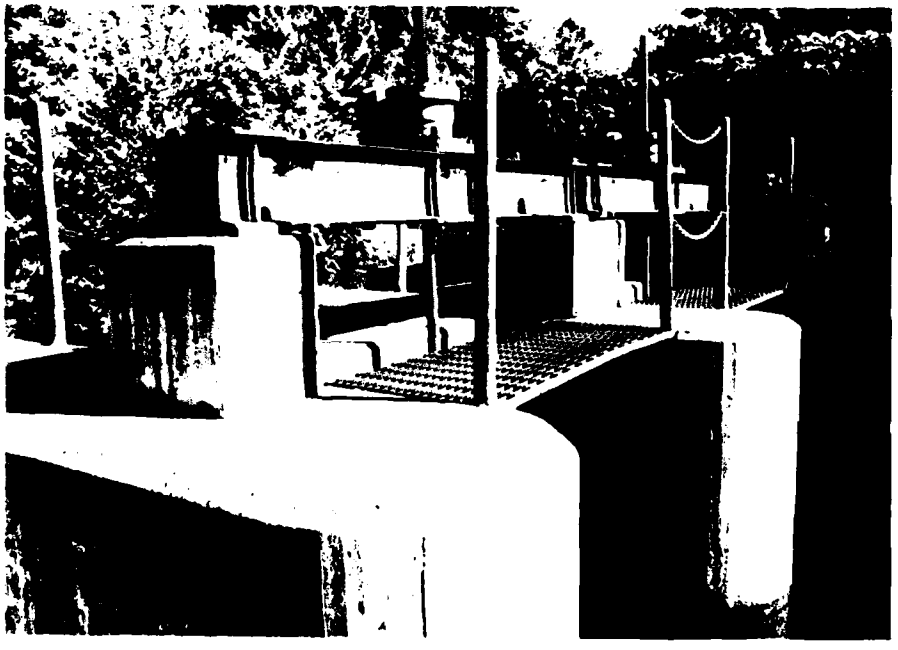


PHOTO NO. 16 - View of control (gate) mechanism at outlet works structure.

PHOTO NO. 17 - View of spillway structure, looking upstream.

PHOTO NO. 18 - View of discharge channel, looking upstream.

PHOTO NO. 19 - View of discharge channel, looking downstream.

PHOTO NO. 20 - View of abandoned electric power station, 450 feet from the dam structure.

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by HM	Date 11/23/78	Job No. E307-11-01
	Checked by [illegible]	Date 11/6/78	Sheet No. 1
For CONWAY DAM - CONWAY, N.H.			

BASIC DATA:

Drainage Area: 23 Square Miles. (D.A. by planimeter & D.A. from NHWRCB)

Size Classification: Based on the Corps of Engineers Guidelines
Intermediate (Storage > 1000 AC-FT.)

Hazard Potential Classification:
Significant.

For dams with an Intermediate Size and Significant Hazard Potential a test flood equal to the $\frac{1}{2}$ PMF is indicated in the Corps' Guidelines.

SPILLWAY DATA:

Permanent spillway top Elev. = 437' MSL.
Effective Length (Min) = 9'-0"
TYPE = Broad crested weir (Stone and earth)
Maximum Freeboard = 3.2 Feet.

DAM DATA:

Type: Gravity earth and Concrete.
Crest Elev. = 441.3' MSL
Length = 200 Feet
Max. Struct. Height =

SPILLWAY CAPACITY DETERMINATION

The spillway is assumed to be a broad-crested weir with a minimum width of 9' and a freeboard of 3.2 feet. For the following formula is used

$Q = C \cdot L \cdot H^{3/2}$ Where: $C = 3.09$

$L = 9'$ (Length)

$H = 3.2'$

$Q = 3.09 \times 9' \times 3.2'^{3/2} = 159 CFS$

Say 160 CFS.

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by	Date	Job No
	Checked by	Date	Sheet No. 2

For CONWAY DAM - CONWAY, N.H.

Due to the insufficient capacity of the spillway the dam (or roadway) will be easily overtopped. The roadway is assumed to behave like a Broad-crested weir. No other control will affect the flow going over the crest of Dam.

Maximum spillway capacity before dam is overtopped:
160 CFS

EFFECT OF SURCHARGE STORAGE ON MAXIMUM PROBABLE DISCHARGE.

Drainage Area = 23 Sq. Mi ✓
Basin Characteristics = rolling Zone
Test Flood = $\frac{1}{2}$ PMF (Significant Hazard + Intermediate Size).

STEP 1 Determine peak Inflow (Q_{P_I}) from guide curves.

From Guide Curve for rolling terrain & d.a = 93 Sq Mi.
Max. Prob. Rate = 1800 CFS/S.M ✓
then $Q_{P_I} = \frac{1}{2}\left[1800 \frac{CFS}{S.M.} \times 23 \text{ Sq. Mi}\right] = 16,100$ CFS ✓

STEP 2 Determine surcharge height to pass Q_P.

The crest of the dam (or roadway embankment) at elevation 611.2' M.S.L. is assumed to act as a broad-crested weir. Accordingly:

$Q_c = C L H^{3/2}$

where C = 3.00
L = 300'
H = head over the crest
Q_c = Flow over the crest

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by HM	Date 10/31/78	Job No 8107-11-04
	Checked by [illegible]	Date 11/6/78	Sheet No 3
For CONWAY LAKE DAM.			

EFFECT OF SURCHARGE STORAGE ON MAX. (CONT).

Elev. 450.01' MSL (From Fig 1) to pass $Q_{P_1} = 16{,}100$

b) Compute $STOR_1$ in inches of Runoff.

$$STOR_1 = \frac{(450.01' - 441.3') \times 129.9\,Ac}{23.5\,SM \times 640\,A/SM} \times 12"/FT = 9.29"$$

c) Compute $Q_{P_2} = 16{,}100^{CFS} \times \left[1 - \frac{9.29"}{9.5}\right] = 360$ CFS.

STEP 3 A) Determine Surcharge Height and $STOR_2$ to pass $Q_{P_2} = 360$ CFS. → EL. 442.0'

B) $$STOR_2 = \frac{(442.0' - 441.3') \times 1299\,Ac}{23.5\,SM \times 640\,Ac/SM} \times 12"/FT = 0.74"$$

C) $$STOR_{AVG} = \frac{9.29" + 0.74"}{2} = 5.02"$$

D) $$Q_{P_3} = 16{,}100\ CFS \times \left[1 - \frac{5.02"}{9.5"}\right] = 7{,}590\ CFS$$

STEP 4. A) Determine Surcharge Height and $STOR_2$ to pass $Q_{P_3} = 7{,}590^{CFS}$ → EL. 446.62'

B) $$STOR_3 = \frac{(446.62' - 441.3') \times 1299\,Ac \times 12"/FT}{23.5\,SM \times 640\,Ac/SM} = 5.64"$$

C) $$STOR_{AVG} = \frac{5.02" + 5.64"}{2} = 5.33"$$

D) $$Q_{P_4} = 16{,}100\ CFS \times \left[1 - \frac{5.33"}{9.5"}\right] = 7{,}070\ CFS.$$

ML101

EFFECT OF SURCHARGE STORAGE

STEP 5 A) Determine Surcharge Height to pass Q_{P_4} = 7,070 CFS! → EL. 446.38'

B) $STOR_4 = \frac{(446.38' - 441.3') \times 1299 Ac \times 12"/FT}{23 SM \times 640 Ac/SM} = 5.38"$

C) $STOR_{AVG} = \frac{5.33" + 5.38"}{2} = 5.36"$

D) $Q_{P_5} = 16,100 \times \left[1 - \frac{5.36"}{9.5"}\right] = 7,020$ CFS.

EL. 446.35'

$STOR_5 = \frac{(446.35' - 441.3') \times 1299 Ac \times 12"/FT}{23 SM \times 640 Ac/SM} = 5.35"$ OK

No more iterations are needed. Q_{P_5} = 7,020 CFS

CONCLUSIONS:

1. The test flood discharge Q = 7,020 CFS will overtop the crest of the dam by about 5 feet
2. The spillway has only the capacity of 160 CFS, which is the 2.3% of the test flood discharge.

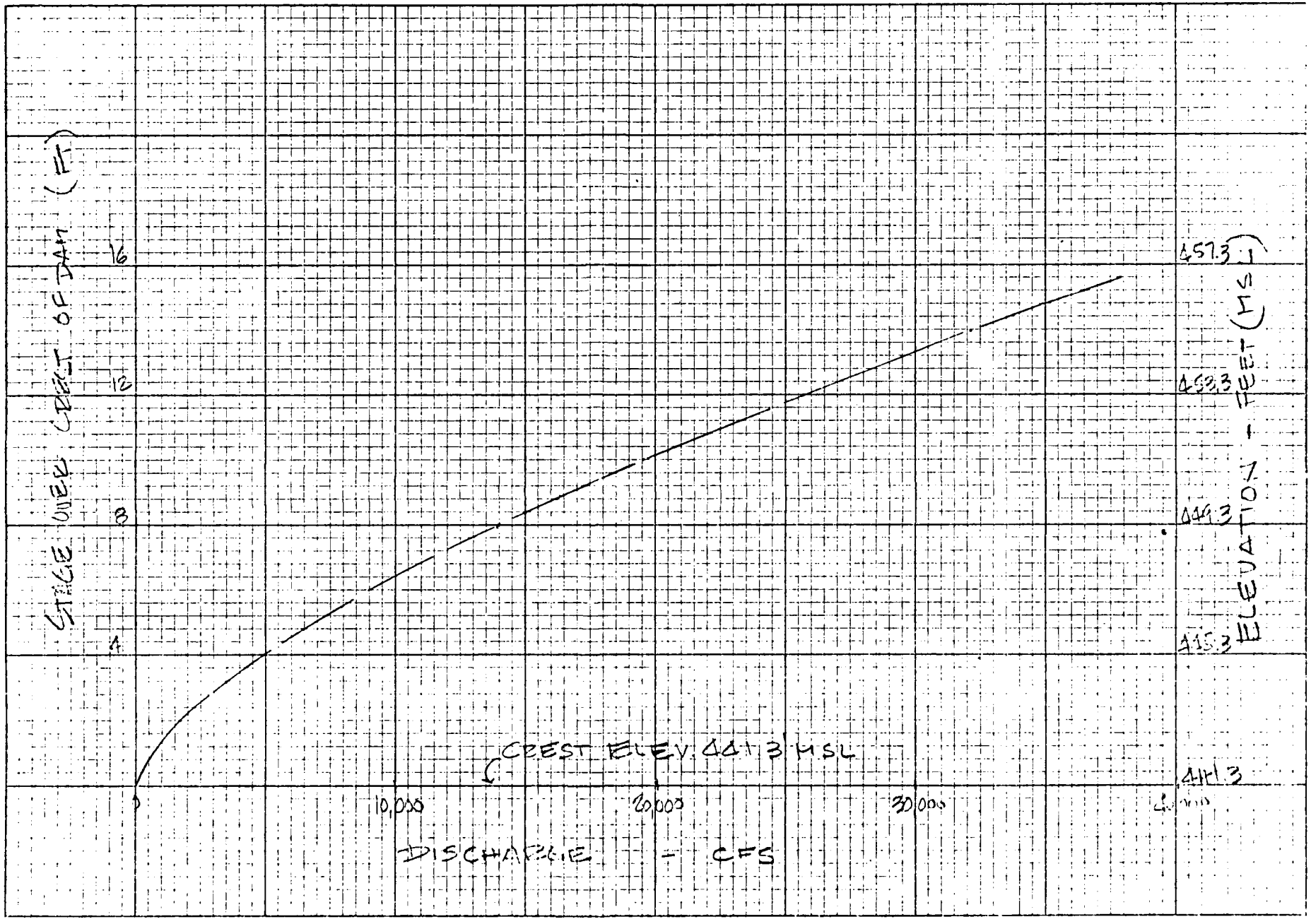

STAGE OVER CREST OF DAM (FT)
16
12
8
4
0
10,000
20,000
30,000
DISCHARGE - CFS
CREST ELEV. 441.3 MSL
457.3
453.3
449.3
445.3
441.3
ELEVATION - FEET (MSL)

FIG 1

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by HM	Date 10/23/78	Job No. 5622-11-04
	Checked by [illegible]	Date 11/6/78	Sheet No. 5
For CONWAY DAM			

ESTIMATING DOWNSTREAM DAM FAILURE HYDROGRAPHS:

STEP 1 Determine or estimate the reservoir storage (S), in A-F at time of failure:

From data (USHWRB):

Normal @ Elev. 437' MSL) = 7,300 AC-FT.

Maximum (@ Elev. 440.08) = 11,500 AC-FT.

At Moment of Failure (EL. 443') = 12,885 AC-FT

Then $S = 12,885$ A-F.

STEP 2: Determine Peak Inflow outflow (Q_{P_1})

$$Q_{P_1} = \frac{8}{27} \times \sqrt{g} \times W_b \times \varphi_o^{3/2}$$

W_b = Breach width (Use 40% of total length)
= $200' \times 0.4 = 80'$

φ_o = 13'-10" (From U.H.W.C.C.) (Max. Height
= 13.83'

$$Q_{P_1} = 1.68 \times 80' \times (13.83)^{1.5} = 6,915 \text{ CFS.}$$

$Q_{P_1} = 6,915$ CFS ✓

STEP 3 Prepare Stage - Discharge curve for this section.

Breach Data		Channel Data
Length	= 4500'	Shape. Trapezoidal.
Slope	= 0.0022 V/V	Bank Slopes. 25:1 & 50:1
Manning's (n)	= 0.08	Base width = 540

STEP 4 A) Determine the stage for $Q_P = 6,915$ CFS.
From fig. 2. The Stage = 4.64 Feet = for $Q_P = 6915$ CFS

ME101-374-20M

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by HM	Date 10/22/78	Job No 522-11-04
	Checked by PWP	Date 11/6/78	Sheet No 6
For COLWARD DAM.			

ESTIMATING DOWNSTREAM DAM FAILURE HYDROGRAPHS (CONT)

Area = 3312 ▱ Length = 4,500'

U_1 (Volume) = $\frac{3,312 \text{ ▱} \times 4,500'}{43,560}$ = 342 A.F

B) Determine Q_{P_2} (Trial) = $Q_{P_1} \times \left[1 - \frac{U_1}{S}\right]$

= 6915 CFS $\times \left[1 - \frac{342 \text{ AF}}{12885 \text{ AF}}\right]$ =

$Q_{P_{2(T)}}$ = 6,730 CFS.

c) Compute U_2 using stage fro $Q_{P_{2(T)}}$ = 6,730

From Fig 2

Stage = 4.56 Feet. Area = 3,242 ▱

U_2 = $\frac{3,242 \text{ ▱} \times 4,500}{43560}$ = 325 A-F

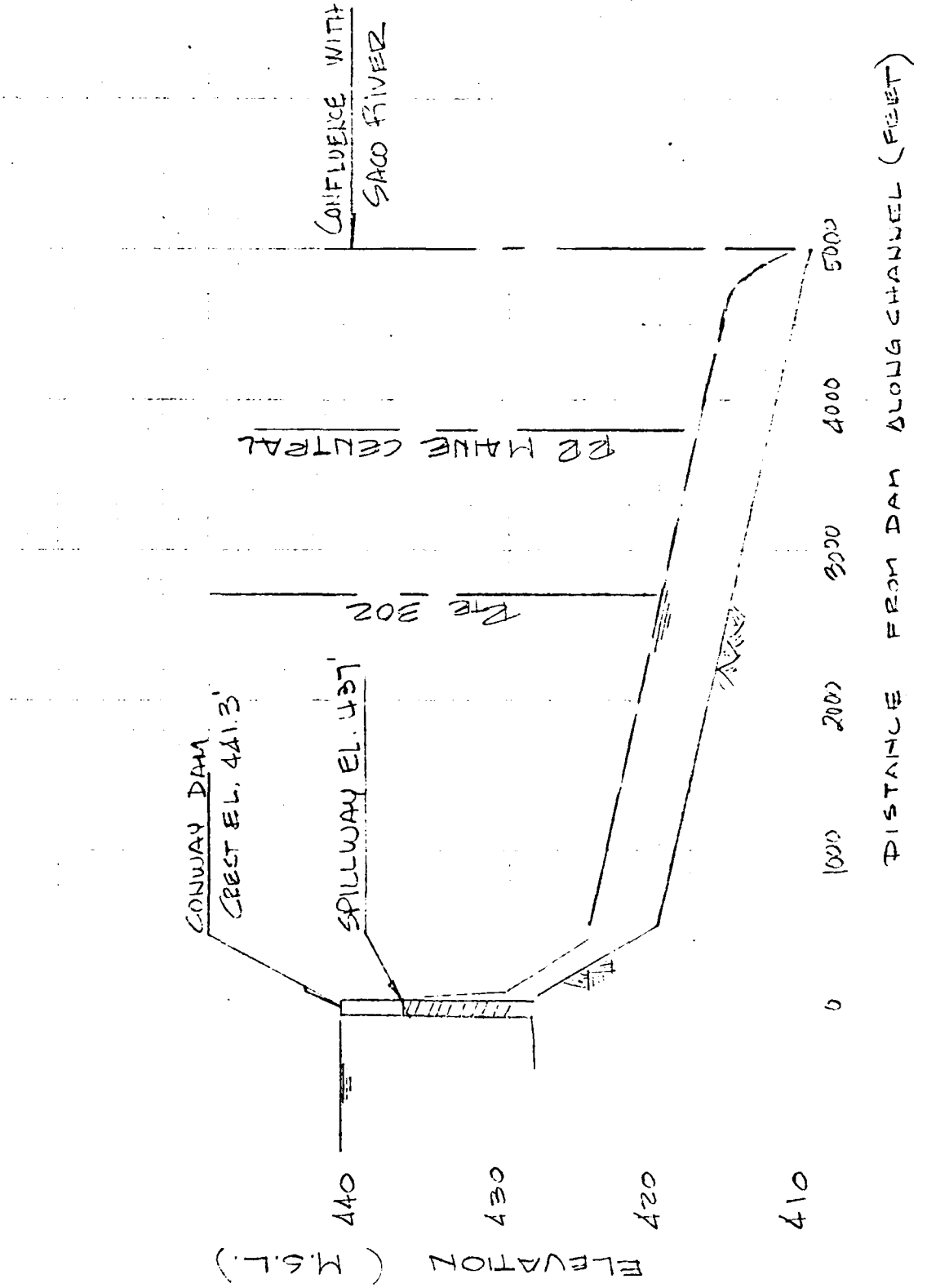
d) Average U_1 & U_2

V_{avg} = (342 AF + 325 AF) $\times \frac{1}{2}$ = 338.5 AF

Then Q_{P_2} = 6,915 CFS $\times \left[1 - \frac{338.5 \text{ AF}}{12,885 \text{ AF}}\right]$ = 6,733 CFS

Q_{P_2} = 6,733 CFS.

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by HM	Date 10/24/78	Job No. 53 28 -11-04
	Checked by RJP	Date 11/6/78	Sheet No. 7
Calculations For CONWAY LAKE DAM			



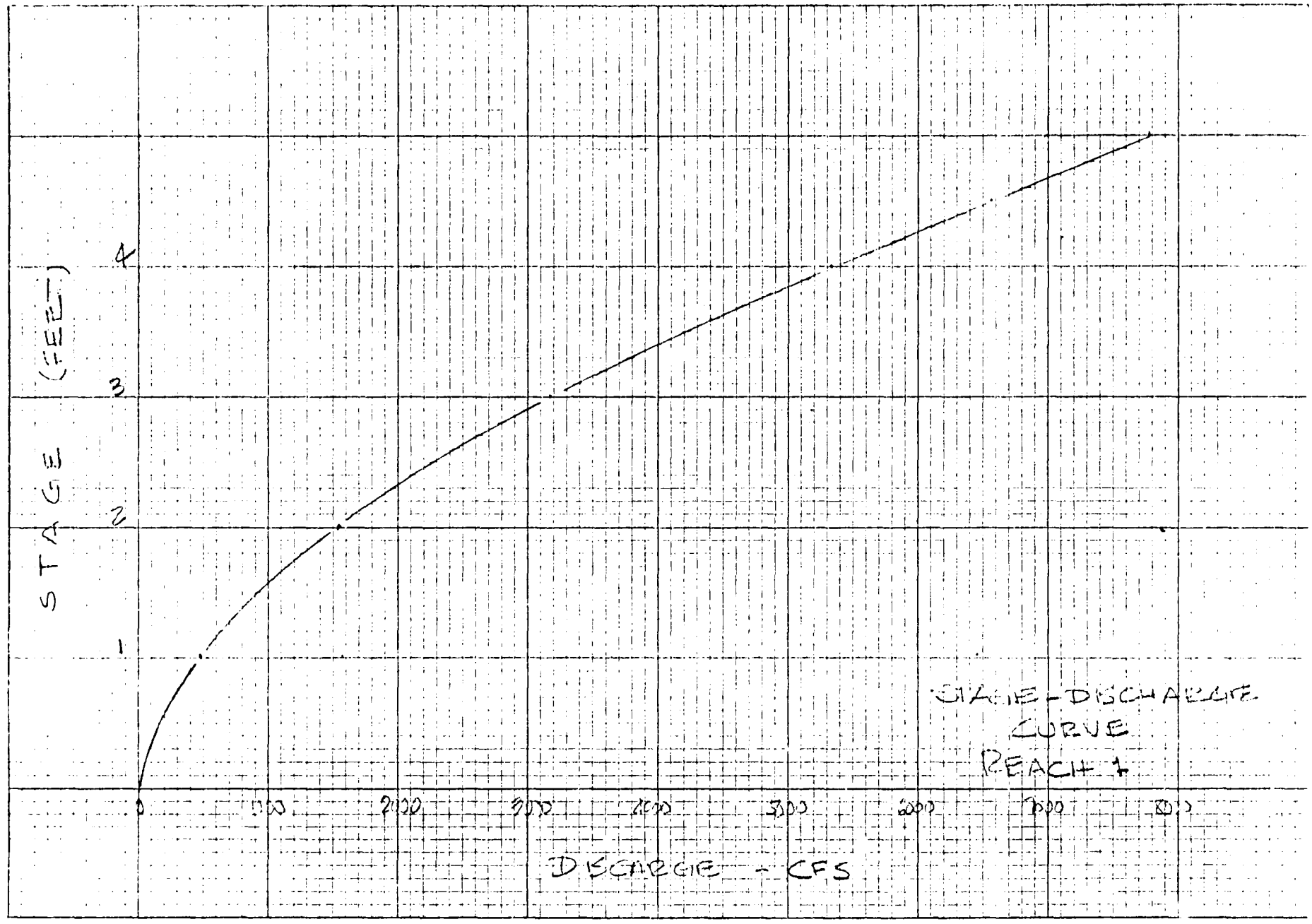
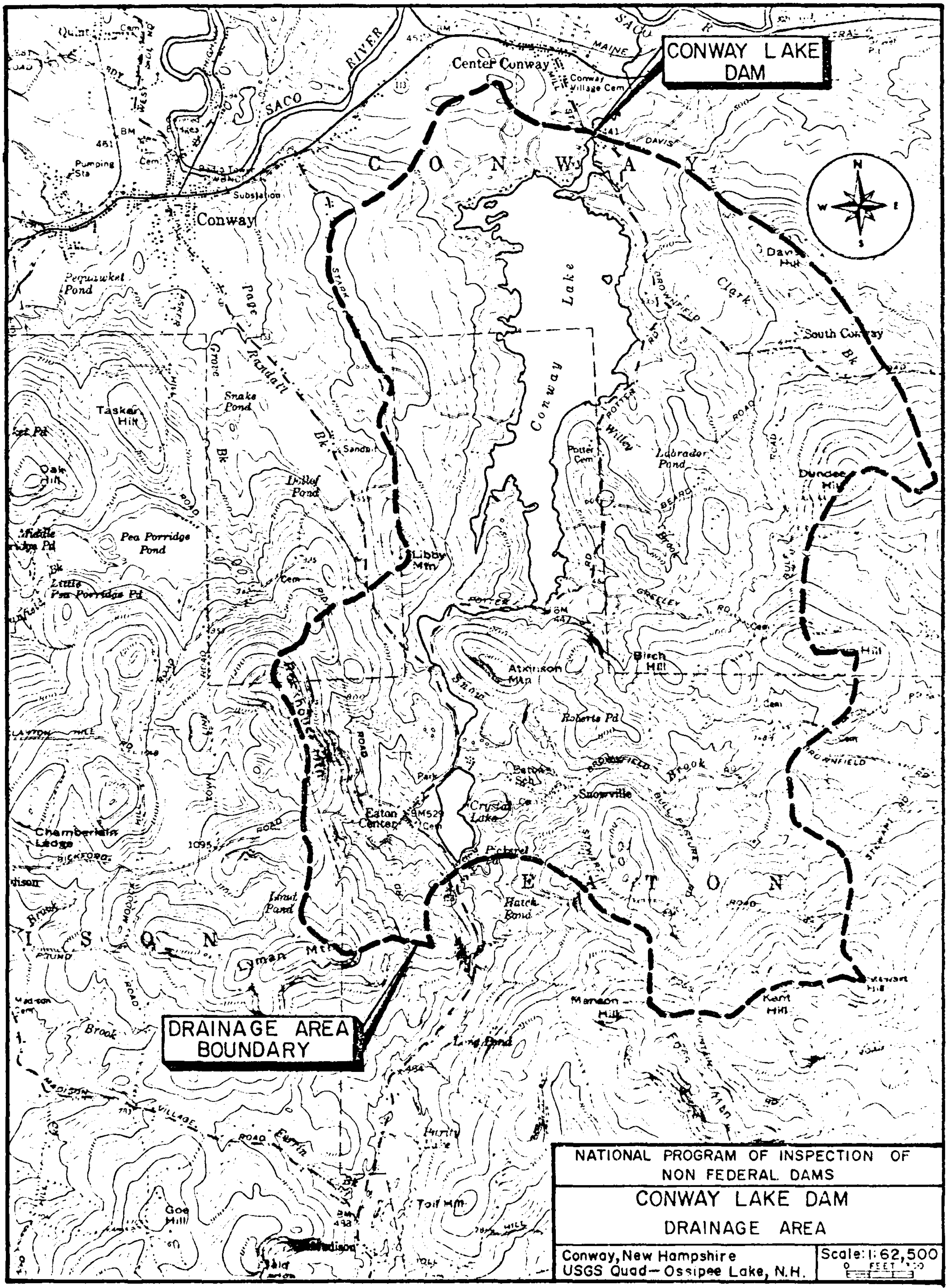

STAGE (FEET)
4
3
2
1
0
1000
2000
3000
4000
5000
6000
7000
8000
DISCHARGE - CFS
STAGE-DISCHARGE CURVE
REACH 1

FIG 2



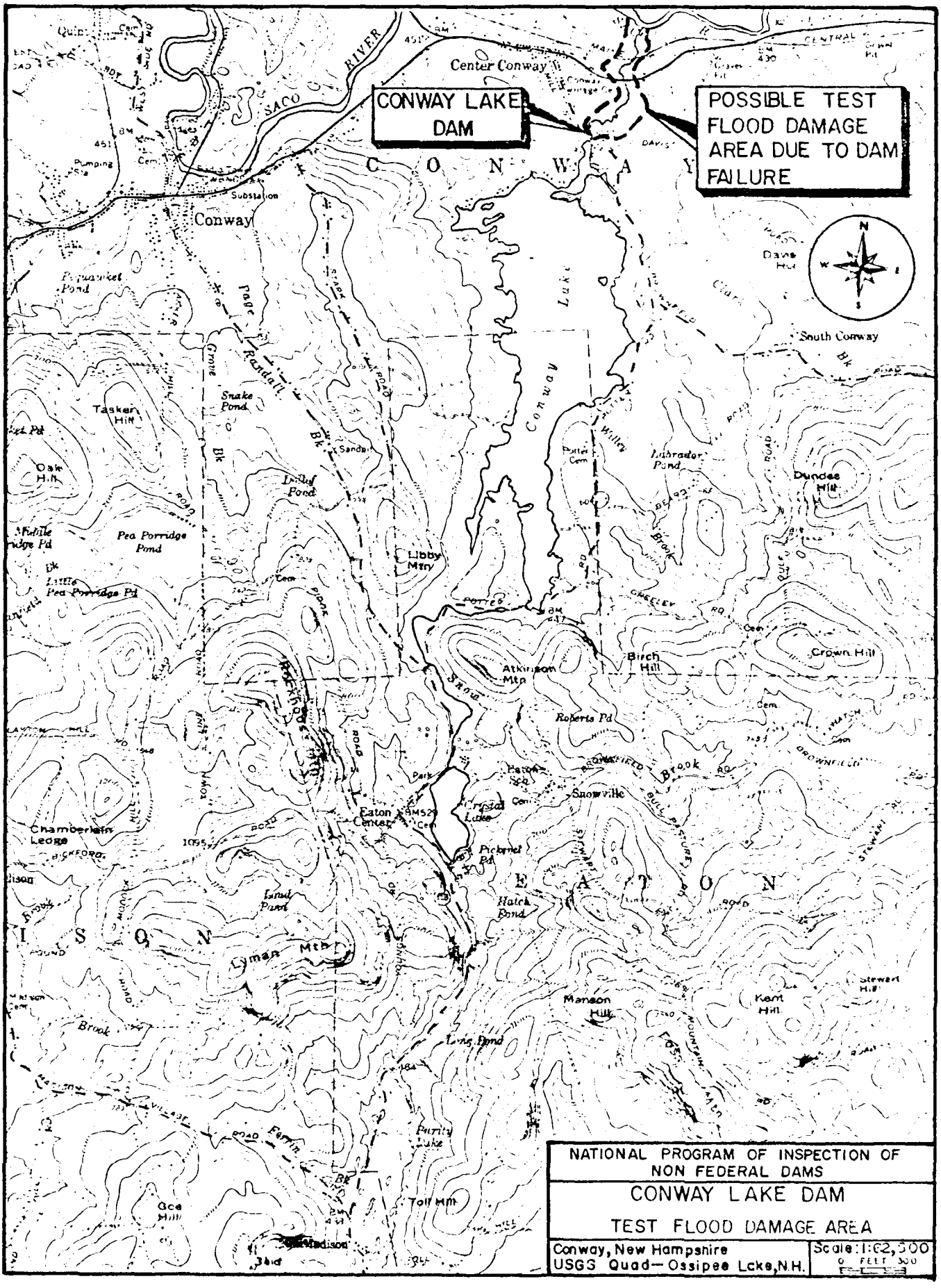
NATIONAL PROGRAM OF INSPECTION OF NON FEDERAL DAMS

CONWAY LAKE DAM

DRAINAGE AREA

Conway, New Hampshire
USGS Quad—Ossipee Lake, N.H.

Scale: 1:62,500



NATIONAL PROGRAM OF INSPECTION OF NON FEDERAL DAMS

CONWAY LAKE DAM

TEST FLOOD DAMAGE AREA

Conway, New Hampshire
USGS Quad—Ossipee Lcke, N.H.

Scale: 1:62,500
0 FEET 500

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTITY NUMBER	DIVISION	STATE	COUNTY	CONGR DIST.	STATE	COUNTY	CONGR DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY | MO | YR
NH	318	NED	NH	003	01				CONWAY LAKE DAM	4359.1	7103.2	10NOV78

POPULAR NAME	NAME OF IMPOUNDMENT
CONWAY LAKE DAM	CONWAY LAKE

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	DIST FROM DAM (MI.)	POPULATION
01	04	TR-SACO RIVER	CONWAY	0	4865

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE–FT.)	IMPOUNDING CAPACITIES NORMAL (ACRE–FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
REGNCTDG	1936	R	17	17	13085	7300	NED	N	N	N	N	4DEC78

REMARKS

D/S HAS	SPILLWAY CREST LENGTH	SPILLWAY TYPE	SPILLWAY WIDTH (FT.)	MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROPOSED (MW)	NAVIGATION LOCKS NO	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
2	200	U	9	160												

OWNER	ENGINEERING BY	CONSTRUCTION BY
TOWN OF CONWAY		

REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NH WATER RES BOARD	NH WATER RES BOARD	NH WATER RES BOARD	NH WATER RES BOARD

INSPECTION BY	INSPECTION DATE DAY | MO | YR	AUTHORITY FOR INSPECTION
HOWARD NEEDLES TAMMEN + BERGENDRF	12SEP78	PL 92-367

REMARKS

END

FILMED

8-85

DTIC